

**REMARKS**

This application has been amended. In particular, claim 1 has been amended to address the rejection under 35 U.S.C. 112, second paragraph and to incorporate the limitation of claim 2 therein. Claim 3 has been rewritten in independent form. Claim 2 has been cancelled. A typographical error in the specification has also been corrected. No new matter has been added. Thus, claims 1 and 3-15 are currently pending.

**Rejections Under 35 U.S.C. §112**

Claims 1-15 stand rejected under 35 U.S.C. §112, second paragraph, for allegedly being indefinite. First, it is alleged that the term “a long carrier” is unclear as to what type of carrier is intended and how the term is used in the claims. Applicants respectfully disagree that usage of this term renders the claims indefinite. The term “long carrier” is used throughout the specification as originally filed and a satisfactory explanation and examples of what is meant by the term can be found, for instance, between line 23 of page 15 and line 18 of page 19. The long carrier is used in the claim to define a component of the ammonia-treating material or, in other words, the ammonia-treating material comprises a long carrier. In the claimed method, the ammonia-treating material (which includes the long carrier) is brought into contact with ammonia containing wastewater. Applicants submit that one skilled in the art would understand what is claimed by the term “long carrier,” especially when the claim is read in light of the specification which provides a thorough discussion and examples relating to this term.

The Office Action further asserts that the process steps for carrying out the claimed method are not entirely clear. Applicants have amended the claims in an attempt to clarify that the claimed process includes (or comprises) the step of bringing an ammonia-treating material and ammonia-containing wastewater into contact with one another to continuously remove ammonia in the wastewater as nitrogen gas. The independent claims go on to define the specifics of the ammonia-treating material and ammonia-containing wastewater which are contacted with one another.

Applicants submit that the claims satisfy the requisite degree of clarity and precision prescribed by statute. Accordingly, it is respectfully requested that the outstanding rejections of claims 1-15 under 35 U.S.C. §112, second paragraph be reconsidered and

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withdrawn. If it is still believed that the claims do not clearly define the invention, Applicants welcome any suggestions the Examiner may have to rectify this issue.

Rejections Under 35 U.S.C. §103(a)

Claims 1-15 stand rejected under 35 U.S.C. §103(a) for obviousness over the article by J.D. Rouse et al. ("Rouse") in view of the article by Hiroyuki Tokitoh et al. ("Tokitoh"), each of which was cited by Applicants in an IDS. Applicants respectfully traverse this rejection.

The invention is directed to a process for treating ammonia-containing wastewater. The process includes bringing an ammonia-treating material and ammonia containing wastewater containing not less than 0.5 mg/l of dissolved oxygen into contact with each other so that the ammonia in the wastewater can be continuously removed as a nitrogen gas. The ammonia-treating material includes a long carrier and a complex bacterial sludge attached and immobilized on the long carrier. The complex bacterial sludge includes both autotrophic anammox bacteria and autotrophic ammonia-oxidizing bacteria. In claim 1, the autotrophic anammox bacteria are attached and immobilized on the fibers or filaments of the long carrier and the autotrophic ammonia-oxidizing bacteria are attached and immobilized on an outer surface of the autotrophic anammox bacteria. In claim 3, the autotrophic anammox bacteria are present within the bacterial sludge which includes the autotrophic ammonia-oxidizing bacteria.

The claimed process for treating ammonia-containing wastewater involves contacting the wastewater with an ammonia-treating material which includes both autotrophic ammonia-oxidizing bacteria and autotrophic anammox bacteria attached and immobilized on a long carrier. Neither the Tokitoh article nor the Rouse article discloses the use of these two types of bacteria in combination for the treatment of wastewater. Instead, these articles only discuss a process in which one of these bacteria types and a carrier are used in the treatment of wastewater.

Moreover, it would not be obvious to modify the cited art to use these bacteria in combination. Because ammonia-oxidizing bacteria are aerobic bacteria, the ammonia-oxidizing bacteria require oxygen for their growth and nitritation of  $\text{NH}_4^+$ . Further, because anammox bacteria are anaerobic bacteria (ANaerobic AMMonium OXidation), these bacteria do not require oxygen for their growth and conversion of  $\text{NH}_4^+$  and  $\text{NO}_2^-$  to  $\text{N}_2$  and water.

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(*See also* Rouse, page 40, “it was found that these [anammox] anaerobic, autotrophic slowly growing bacteria...”). Applicants have found that, by combining the ammonia-oxidizing bacteria and anammox bacteria, which have different growth conditions, into the same ammonia-treating material, both the nitritation and anammox reaction can take place in a single reaction step. Additionally, arranging the annamox bacteria inside of or within the ammonia-oxidizing bacteria forms a complex bacteria sludge having a core-sheath structure with the ammonia-oxidizing bacteria forming the sheath and the annamox bacteria forming the core. Accordingly, the anaerobic conditions needed for the anammox bacteria are maintained and the anammox reaction can take place efficiently even when the wastewater contains dissolved oxygen, necessary for the ammonia-oxidizing bacteria, at a relatively high concentration.

In addition, it is believed that the Office Action has failed to provide an adequate explanation as to why one skilled in the art would utilize ammonia containing wastewater containing dissolved oxygen at a concentration of not less than 0.5 mg/l in the claimed method. The Office Action initially points to Rouse as apparently suggesting that wastewater having an oxygen concentration of not less than 0.5 mg/l should be used. However, the allegedly supporting passage in Rouse mentions only that “dissolved oxygen...is not required.” (Rouse, page 34, col. 1). It is unclear how this limited passage suggests that the oxygen content should be not less than (i.e., greater than or equal to) 0.5 mg/l as recited in the claim. The Office Action then mentions that the claims differ from Rouse in that a dissolved oxygen concentration of not less than 0.5 mg/l and acrylic fibers are not disclosed. Tokitoh is referenced as allegedly teaching acrylic fibers. The Office Action then concludes that “Clearly the reference teaches that dissolved oxygen concentration while it may be present it is not required for the process and hence it can be present at low amounts.” However, no explanation of how, based on the cited art, it is deemed obvious to use wastewater having an oxygen concentration of not less than 0.5 mg/l is provided. “The key to supporting any rejection under 35 U.S.C. §103 is the clear articulation of the reason(s) why the claimed invention would have been obvious.” M.P.E.P. 2141. “[R]ejections on obviousness cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR International Co. v. Teleflex Inc.*, 82 USPQ.2d 1385, 1396 (S.Ct. 2007). In this instance, Applicants respectfully submit that the Office Action has relied on

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conclusory statements, rather than supported reasoning, in reaching the conclusions drawn therein. Accordingly, a *prima facie* case of obviousness has not been established and the outstanding rejections under 35 U.S.C. §103(a) should be reconsidered and withdrawn.

For all the foregoing reasons, Applicants submit that the pending claims are patentable over the prior art of record and are in condition for allowance. Accordingly, reconsideration of the outstanding rejections and allowance of pending claims 1 and 3-15 are respectfully requested.

Respectfully submitted,

THE WEBB LAW FIRM

By Kent E. Baldauf

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Kent E. Baldauf  
Registration No. 25,826  
Attorney for Applicants  
436 Seventh Avenue  
700 Koppers Building  
Pittsburgh, PA 15219  
Telephone: (412) 471-8815  
Facsimile: (412) 471-4094  
E-mail: webblaw@webblaw.com